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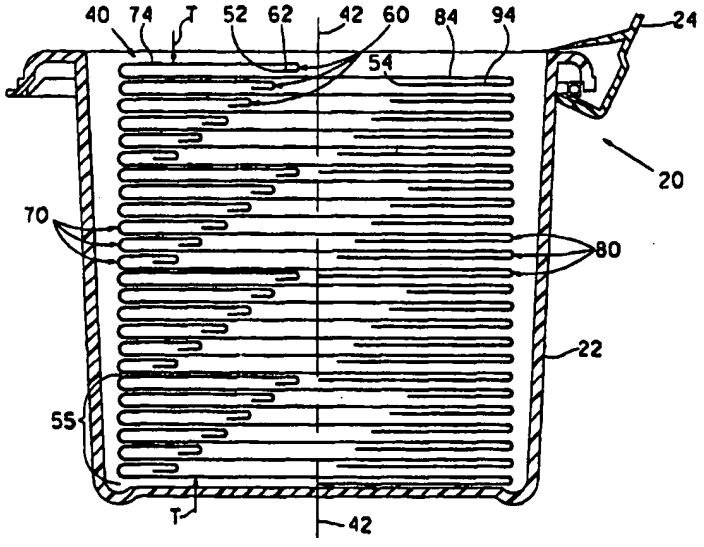

(57) Abstract

An assembly of discrete, folded premoistened wipes (50) are disposed one next to another to form a vertical stack (40) within a container (20). Each premoistened wipe (50) extends from a first end edge (52) to a second end edge (54), and each wipe has an edge fold (60) positioned adjacent to and spaced from the first end edge (52). The edge fold (60) provides a double thickness of the wipe adjacent to the end edge (52). The double thickness provided by the edge fold (60) facilitates grasping of the wipe (50) from the container (20). The positions of the edge folds (60) are staggered in a predetermined, repeating manner in the stack (40) in order to maintain a generally uniform stack height.

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ASSEMBLY OF WEBS HAVING STAGGERED EDGE FOLDS

FIELD OF THE INVENTION

This invention is related to folded webs, and more particularly to folded, premoistened wipes having an edge fold.

BACKGROUND OF THE INVENTION

Premoistened wipes, or wet wipes, are well known in the art. For instance, it is well known to use premoistened wipes for cleaning, including general cleaning of surfaces as well as personal cleaning of various body parts. One well known use for premoistened wipes is in cleaning an infant when changing the infant's diaper.

Premoistened wipes are typically provided in a stacked configuration within a covered container, such as tub-like container having a lid. The wipes are typically folded, and can be withdrawn from the container in a one-at-a-time fashion, as needed.

One problem with such an arrangement is that it can be difficult to grasp the wipe for removal from the container. The leading end edge of the wipe is relatively thin, and can be difficult to grasp. In addition, the leading end edge of the wipe tends to resist separation from the underlying portion of the wipe. This resistance can be due, at least in part, to adherence between portions of the wipe caused by the liquid composition which is used to moisten the substrate of the wipe. As a result, it can be difficult to grasp and remove a wipe from the container with one hand. One hand dispensing is especially desirable when changing an infant's diaper.

One way to reduce the difficulty in dispensing wet wipes is by introducing an edge fold adjacent the leading end edge of each wipe. The edge fold provides added thickness for grasping. However, such edge folds, when aligned vertically in a stack, result in a non-uniform stack thickness. A generally uniform stack thickness is desirable in order to simplify handling and packaging of the stack, and to provide an appealing product appearance.

Accordingly, it is an object of the present invention to provide an assembly of folded webs, such as folded premoistened wipes, which can be easily dispensed.

Another object of the present invention is to provide a generally uniform thickness stack of discrete, folded premoistened wipes which can be easily dispensed in a one-at-a-time fashion.

Another object of the present invention is to provide a stack of premoistened wipes having staggered edge folds.

SUMMARY OF THE INVENTION

The present invention provides an assembly of discrete, folded webs disposed one next to another to form a stack. In one embodiment, an assembly of discrete, folded premoistened wipes is provided. The wipe substrate comprises a fibrous web, and the wipes are disposed one next to another to form a stack within a container. The premoistened wipes can be non-interfolded in the stack.

Each web extends lengthwise from a first, leading end edge to a second, trailing end edge. Each web has an edge fold positioned adjacent to, and spaced from, the first, leading end edge to provide a web lip extending between the edge fold and the first, leading end edge of the web. The web lip provides a double thickness of the web adjacent to the leading end edge, and facilitates grasping of the web.

The positions of at least some of the edge folds are staggered in the stack, so that all of the edge folds are not aligned with each other. Staggering of the edge folds reduces variation in the thickness of the stack which would otherwise occur in the absence of staggering.

The positions of the edge folds are preferably staggered a distance at least as great as the spacing between the edge fold and the first, leading edge of the web. The spacing between the edge fold and the first, leading edge of the web is preferably less than about 0.75 inch, more preferably less than about 0.5 inch, and in one embodiment is between about 0.15 inch and about 0.35 inch.

Each web can include a first panel fold generally parallel to the edge fold. The first panel fold is spaced from the edge fold to provide a first web panel extending between the first panel fold and the edge fold. A second web panel is joined to the first web panel at the first panel fold. Each web can also include a second panel fold and a third web panel. The third web panel is joined to the second web panel at the second panel fold. The web is folded at the first and second panel folds to provide the first, second, and third web panels in a Z-fold configuration. Alternatively, other fold configurations, including but not limited to C-folds and J-folds, can be used.

At least one web in the stack has spacing between the edge fold and the first panel fold which is different from the spacing between the edge fold and the first panel fold on one or more other webs in the stack. The spacing between the edge fold and the first panel fold can vary in a predetermined, repeating manner to provide staggering of the positions of the edge folds in predetermined, repeating manner within the stack.

A method is also provided for forming a stack of folded wipes having staggered edge folds. The method includes the steps of providing at least two continuous webs; forming an edge fold on each continuous web; and forming a first panel fold on each continuous web, such that the spacing of the edge fold from the first panel fold on at least one of the continuous webs is different from the spacing of the edge fold from the first panel fold on at least one of the other continuous webs. The method also includes the step of forming discrete folded webs from each of the folded continuous webs, and stacking the discrete folded webs one on top of another to form a stack of the discrete folded webs having edge folds staggered within the stack.

In one embodiment, the method includes the steps of conveying at least three continuous webs in three separate lanes, and providing a folding apparatus corresponding to each of the continuous webs. The three continuous webs are each positioned differently relative to their respective folding apparatuses to provide three folded continuous webs having three different spacings of the edge fold from the first panel fold.

BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctly claiming the present invention, it is believed the present invention will be better understood from the following description in conjunction with the accompanying drawings in which:

Figure 1 is perspective illustration of a folded web having an edge fold.

Figure 2 is a cross-sectional schematic illustration of the stack of folded webs in a container, the illustration showing staggering of the edge folds in the stack according to the present invention.

Figure 3 is a cross-sectional illustration taken along lines 3-3 in Figure 1 showing a folded web having an edge fold which provides a web lip "folded under", and the web folded to have first, second and third web panels in a Z-fold configuration.

Figure 4 is a cross-sectional illustration of alternative embodiment of a folded web having an edge fold which provides a web lip overlying a portion of a first web panel.

Figure 5 is a schematic illustration of a relatively wide parent web being slit into six generally equal width, continuous webs.

Figure 6 is a schematic illustration of the continuous webs of Figure 5 being folded simultaneously on separate folding pan assemblies positioned in six parallel

lanes, and the folded continuous webs being stacked one on top of another to form a portion of a stack of folded webs having staggered edge folds.

Figure 7 is enlarged schematic illustration of three folding pan assemblies shown in Figure 6 showing the lane-to-lane variation of the position of the continuous webs with respect to the folding pan assemblies.

Figure 8 is a cross-sectional schematic view taken along lines 8-8 in Figure 6 showing an edge fold being formed on a continuous web upstream of folding pan assemblies as the edge of the web is conveyed through a folding tunnel.

Figures 9A-C are enlarged schematic illustrations similar to the illustration of Figure 7, except that the edge folds are shown being formed by folding blocks positioned along the folding pan assemblies at different locations, the positions of the folding blocks on the folding pan assemblies varying from lane-to-lane.

Figure 10 is a cross-sectional schematic illustration taken along lines 10-10 in Figure 9A showing the cross-section of the folding block and an edge fold formed after the path of the edge of the continuous web has been interrupted by the folding block.

Figure 11 is a side view schematic illustration of a continuous web being folded as the web is conveyed over a folding pan assembly shown in Figure 6.

DETAILED DESCRIPTION OF THE INVENTION

The term "wipe" refers to an article comprising a substrate, such as a fibrous substrate, and intended to be used for removal of a substance from a surface or object which is animate or inanimate, or alternatively, application of a material to a surface or object which is animate or inanimate. "Wipes" include articles with fibrous substrates used for human or animal cleansing or wiping, including but not limited to human cleansing and wiping such as anal cleansing, perineal cleansing, genital cleansing, and face and hand cleansing. "Wipes" also include articles used for application of substances to the body, including but not limited to application of make-up, skin conditioners, ointments, and medications. "Wipes" further include such articles used for cleaning or grooming of pets. Additionally, "Wipes" include articles with fibrous substrates used for general cleansing of surfaces and objects, such as household kitchen and bathroom surfaces, eyeglasses, excercise and athletic equipment, automotive surfaces, and the like.

The term "premoistened wipe" refers to a wipe which includes a substrate which is moistened, such as by impregnating the substrate with a liquid composition, prior to use

by the consumer. In particular, "premoistened wipes" refers to wipes having a substrate which is moistened prior to packaging, such as in a generally moisture impervious container or wrapper.

Figure 1 provides a perspective view of a folded web 50 having an edge fold 60. Figure 2 is a cross-sectional illustration of a stack 40 of folded webs 50 in a container 20. The container 20 includes a tub portion 22 and a lid 24 (shown cut away) pivotably joined to the tub portion 22, such as by a hinge mechanism. U.S. Patent 5,065,887 issued Nov. 19, 1991 is incorporated herein by reference for the purpose of disclosing a suitable container 20.

The folded webs 50 are shown stacked vertically in the tub portion 22 in Figure 2. Figure 2 illustrates staggering of the edge folds 60 of the folded webs 50 according to the present invention. Figure 3 shows a single folded web 50.

Alternatively, the wipes can be stacked and then packaged in a moisture impervious wrapper, such as a foil or polymeric film wrapper, to provide a refill package for use in refilling the container 20.

The folded web 50 can comprise a woven or nonwoven web of natural fibers, or mixtures of natural and synthetic fibers. Suitable natural fibers include but are not limited to cellulosic fibers, such as wood pulp fibers and cotton. Suitable synthetic fibers include fibers commonly used in textiles, including but not limited to polyester, polypropylene, and rayon fibers.

Various forming methods can be used to form a fibrous web from which the folded web 50 is made. For instance, the web can be made by nonwoven dry forming techniques, such as air-laying, or alternatively by wet laying, such as on a papermaking machine. Other nonwoven manufacturing techniques such as melt blown, spunbonded, needle punched, and spun laced methods may also be used.

The dry fibrous web can be an airlaid nonwoven web comprising a combination of natural and synthetic fibers and a latex binder. In one embodiment, the fibrous web can comprise wood pulp fibers and polyester fibers, with a styrene butidiene resin binder. The dry fibrous web can be about 20-80 percent by weight wood pulp fibers, 20-60 percent by weight polyester fibers, and about 10-25 percent by weight binder.

The folded web 50 can comprise a fibrous web substrate impregnated with a liquid composition to provide a premoistened wipe. The liquid composition can be water based, and can include a number of additional ingredients, including but not limited to, preservatives, cleansers, fragrances, and lotions. The dry, fibrous web, prior to being impregnated with the liquid composition, can have a thickness of between about 0.017

and 0.060 inch and a basis weight of between about 20 and about 75 pounds per 2880 square feet.

In one embodiment, the liquid composition with which the fibrous web is impregnated can be water based, and include a mild surfactant, an emollient, fragrance ingredients, and preservatives. The dry substrate can be saturated with about 2.5 to about 4.5 grams of the liquid composition per gram of the dry fibrous web.

A suitable dry fibrous web substrate impregnated with a liquid composition is marketed by The Procter & Gamble Company as BABY FRESH brand baby wipes and PAMPERS BABY FRESH brand baby wipes.

The following patents are incorporated herein by reference for their disclosure of fibrous substrates and liquid compositions with which substrates can be moistened: U.S. Patent 3,862,472 issued Jan 28, 1975; U.S. Patent 3,982,302 issued Sept. 28, 1976; U.S. Patent 4,004,323 issued Jan. 25, 1977; U.S. Patent 4,057,669 issued Nov. 8, 1977; U.S. Patent 4,097,965 issued July 4, 1978; U.S. Patent 4,176,427 issued Dec. 4, 1979; U.S. Patent 4,130,915 issued Dec. 26, 1978; U.S. Patent 4,135,024 issued Jan. 16, 1979; U.S. Patent 4,189,896 issued Feb. 26, 1980; U.S. Patent 4,296,161 issued Oct. 20, 1981; U.S. Patent 4,309,469 issued Jan 25, 1982; U.S. Patent 4,419,403 issued Dec. 6, 1983; U.S. Patent 4,682,942 issued July 28, 1987; U.S. Patent 4,732,797 issued March 22, 1988; U.S. Patent 4,772,501 issued March 22, 1988; U.S. patent 4,904,524 issued Feb. 27, 1990; U.S. Patent 4,941,995 issued July 17, 1990; and U.S. Patents 4,637,859; 5,223,096; 5,240,562; 5,556,509; and 5,580,423.

Referring to Figures 1-3, each folded web 50 extends lengthwise from a first, leading end edge 52 to a second, trailing end edge 54. The folded webs 50 also have side edges 56 and 58 which extend lengthwise from the first leading end edge 52 to the second trailing end edge 54.

Each folded web 50 has an edge fold 60. The edge fold 60 is generally parallel to the end edge 52, and generally perpendicular to the side edges 56 and 58. The edge fold 60 is positioned adjacent to, and spaced from, the end edge 52 to provide a web lip 62. The web lip 62 extends between the edge fold 60 and the end edge 52.

The edge fold is the fold positioned closest to the first, leading end edge 52. The edge fold provides a web lip 62 which has a length less than the length of an adjacent panel of the web. A "panel" is a portion of the web extending between two folds, or between a fold and an edge end. The spacing between the edge fold 60 and the first, leading end edge 52 is preferably less than about 0.75 inch, more preferably less than about 0.50 inch, and even more preferably between about 0.15 inch and about 0.35 inch. The spacing between the edge fold 60 and the leading edge 52 can be about 0.25 inch.

The positions of at least some of the edge folds 60 are staggered in the stack 40, as shown in Figure 2, such that all of the edge folds 60 are not aligned with each other. Staggering of the edge folds 60 reduces the variation in the thickness T (Figure 2) of the stack which would otherwise occur in the absence of staggering. In Figure 2, the edge folds 60 are staggered in a predetermined, repeating pattern. The edge folds 60 are preferably staggered a distance at least as great as the spacing between the edge fold 60 and the first end edge 52 so that portions of the web lips 62 are not in overlying alignment.

Referring to Figures 1 and 3, each folded web 50 can include a first panel fold 70 which is generally parallel to the edge fold 60, and which is generally perpendicular to the side edges 56 and 58. The first panel fold 70 is spaced lengthwise from the edge fold 60 to provide a first web panel 74 extending between the first panel fold 70 and the edge fold 60.

The folded web 50 can also include a second panel fold 80, and second and third web panels 84 and 94. The second panel fold 80 is generally parallel to, and spaced lengthwise from, the first panel fold 70. The second web panel 84 is joined to the first web panel 74 at the first panel fold 70, and extends between the first panel fold 70 and the second panel fold 80.

The third web panel 94 is joined to the second web panel 84 at the second panel fold 80. The third web panel 94 extends between the second panel fold 80 and the second, trailing end edge 54. The web is folded at the first and second panel folds 70 and 80 to provide the first, second, and third web panels 74, 84, and 94 in a Z-fold configuration, as best seen in Figure 3. In the Z-fold configuration, panel 74 is adjacent to and overlies a portion of panel 84, and panel 94 is adjacent to and underlies a portion of panel 84. Panel 74 extends from the fold 70 toward the center of panel 84, and panel 94 extends from fold 80 toward the center of panel 84.

Referring to Figure 2, the folded webs 50 are non-interfolded in the stack 40, so that each folded web 50 can be dispensed from the container 20 without disturbing the adjacent, underlying folded web 50. Alternatively, it may be desirable in some alternative embodiments to interfold adjacent folded webs 50. For instance, a panel such as panel 94 on one folded web 50 could be interleaved between panels 74 and 84 of an adjacent, underlying folded web.

The staggering of the edge folds 60 in the stack 40 can be provided by varying the spacing between the edge fold 60 and the first panel fold 70 among at least some of the folded webs 50 in the stack 40. Referring to Figure 2, the spacing between the edge fold 60 and the first panel fold 70 varies in a predetermined, repeating pattern. In Figure 2,

there are six different values of the spacing between the edge fold 60 and the first panel fold 70, and the pattern repeats in groups of six folded webs 50. Such a group of six folded webs 50 is indicated by bracket 55 in Figure 2. The spacing between the edge fold 60 and the first panel fold 70 is different for adjacent folded webs 50.

If the folded webs 50 are numbered 1 to 12, starting with the top folded web 50 in Figure 2, the spacing between the edge fold 60 and the first panel fold 70 is maximum for the 1st and 7th folded webs 50, and minimum for the 6th and 12th folded webs 50. Only 24 folded webs 50 are shown in Figure 2 for illustration purposes, but it will be understood that many more folded webs can and normally will be included in the container 20.

In one nonlimiting, illustrative example, each folded web 50 can have an unfolded length of about 8.5 inches as measured lengthwise from end edge 52 to end edge 54. Each of the folded webs 50 can have an edge fold 60 spaced about 0.25 inch from the end edge 52. For each of the folded webs, the spacing between the first panel fold 70 and the second panel fold 80 can be about 4.5 inches, while the lengths of the first and third panels vary such that as the length of the first panel increases, the length of the third panel decreases. The spacing between the edge fold 60 and the first panel fold 70 can vary from a maximum of about 2.0 inches for the 1st folded web 50 to a minimum of about 0.75 inch for the 6th folded web 50, with the spacing between the second panel fold 80 and the end edge 54 varying from about 1.5 inches (when the spacing between the edge fold 60 and the first panel fold 70 is maximum) to about 3.0 inches (when the spacing between the edge fold 60 and the first panel fold 70 is minimum).

While the stack 40 in Figure 2 has edge folds 60 which are staggered in a pattern that repeats in groups of six folded webs 50, it will be understood that the edge folds 60 can be staggered in a pattern that repeats in groups of less than, or more than, six folded webs 50. Preferably, there are at least three different staggered positions of the edge folds 60 in the stack 40, with the edge folds 60 staggered in a pattern that repeats in groups of at least three folded webs 50.

In one embodiment having three different staggered positions of the edge folds 60, each folded web 50 can have an unfolded length of about 8.5 inches as measured lengthwise from end edge 52 to end edge 54, and each folded web can have the edge fold 60 spaced about 0.25 inch from the end edge 52. For each folded web 50, the spacing between the first panel fold 70 and the second panel fold 80 can be about 4.5 inches, while the lengths of the first and third panels vary such that as the length of the first panel increases, the length of the third panel decreases. The spacing between the edge fold 60 and the first panel fold 70 can vary from a maximum of about 2.0 inches for the 1st

folded web 50 to a minimum of about 1.5 inch for the 3rd folded web 50, with the spacing between the second panel fold 80 and the end edge 54 varying from about 1.5 inches (when the spacing between the edge fold 60 and the first panel fold 70 is maximum) to about 2.0 inches (when the spacing between the edge fold 60 and the first panel fold 70 is minimum).

Referring to Figure 2, an imaginary midplane of the stack 40 is shown as a line designated by the reference numeral 42. The midplane 42 is spaced equidistant from the first panel folds 70 and the second panel folds 80. By varying the spacing between the edge fold 60 and the first panel fold 70, the positions of the edge folds 60 are staggered relative to the midplane 42. In the embodiment shown in Figure 2, all of the edge folds 60 are located on the same side of the midplane 42. Alternatively, the folded webs 50 could be oriented in the stack 40 such that edge folds 60 are located on both sides of the midplane 42.

In Figures 2 and 3, the edge fold 60 is made such that the web lip 62 is "folded under" to be positioned between portions of the first and second web panels 74 and 84. Folding the web lip 62 under can provide the advantage that the web lip 62 is trapped between the first and second panels 74 and 84, thereby preventing unfolding of the edge fold 60. Alternatively, the edge fold 60 can be made such that the web lip 62 overlies a portion of the first web panel 74, as shown in Figure 4.

The stack 40 of folded webs having staggered edge folds 60 can be provided by hand folding and hand stacking. The webs can be individually hand folded to have varying spacing between the edge fold 60 and the panel fold 70, and then hand stacked to provide staggering of the edge folds 60 in a predetermined, repeating pattern. However, hand folding and stacking is generally expensive and time consuming.

Figures 5, 6, 7, and 8 illustrate a method for forming a stack 40 of folded webs having staggered edge folds 60. Figure 5 shows a continuous parent web 148. The continuous parent web 148 comprises the dry fibrous substrate from which the folded webs 50 are formed. The parent web 148 can have a width W of about 51 inches, and is unwound from a supply roll and slit into six continuous webs designated 150A-150F in Figure 5.

The parent web 148 can be slit by rotating knifes designated 110 in Figure 5. In Figure 5, the parent web 148 and the continuous webs 150A-150F are conveyed generally horizontally. The liquid composition with which the dry fibrous web is impregnated can be applied to each of the continuous webs 150A-150F as the continuous webs are

conveyed generally horizontally. The liquid composition can be delivered to the webs 150A-F by any suitable method, such as by coating the webs with a lotionizing bar 120 having orifices through which a liquid composition under pressure is delivered to a surface of the webs. Alternatively, the webs can be sprayed or immersed in the liquid composition.

In Figure 6, the continuous webs 150A-150F are shown being conveyed generally vertically. The edges 152 and 154 of the continuous webs 150A-150F are shown in Figures 5 and 6. The edges 152 and 154 correspond to the first leading end edges 52 and the second, trailing end edges 54, respectively, of the finished, folded webs 50. The folding of the webs 150A-F takes place simultaneously, along six parallel lanes.

In Figure 6, each of the continuous webs 150A-F is first edge folded adjacent to edge 152 by directing the edges of the continuous webs 150A-F through folding tunnels 200. Figure 8 shows a cross-sectional illustration of an edge fold 160 being shaped on the continuous web 150A by the folding tunnel 200. The folding tunnel 200 has a converging tunnel section 210 which turns the edge 152, thereby forming an edge fold 160 on the continuous web 150A adjacent to the edge 152. The edge fold 160 on a continuous web 150 corresponds to the edge fold 160 on the folded web 50.

The continuous webs 150A-F are then each conveyed over a folding pan assembly. In Figure 6, the folding pan assemblies are designated 300A-F. Each folding pan assembly includes a relatively smaller, triangular shaped folding pan 310 and a relatively larger, triangular shaped folding pan 320 spaced from the folding pan 310 by a gap 330. The folding pan 320 has a tip edge 325 which appears as a point in Figure 6. Such folding pan assemblies are known in the art. Below the folding pan assemblies 300A-F the continuous webs 150A-F are guided between rollers 410 and 420. The continuous webs then pass through a nip formed by nip rollers 430 and 440.

The continuous webs 150A-F are driven by the nip rollers 430 and 440 to be conveyed over the folding pan assemblies 300A-F. The folding of continuous web 150A will be described with reference to Figures 6 and Figure 11. Figure 11 is a side view, schematic illustration showing the continuous web 150A being folded as it is conveyed over the folding pan assembly 300A. As the continuous webs 150A-F are conveyed over the folding pan assemblies 300A-F, the folding pan assemblies impart two folds to the continuous webs 150A-F.

One of the folds, designated 170 in Figure 11, corresponds to the first panel fold 70. Fold 170 is imparted to web 150A as a portion of the continuous web is drawn into the gap 330 between the pans 310 and 320. The fold 170 is initiated as the web is conveyed over the leading edges (upper edges in Figure 6) of the folding pans 310 and

320 and drawn into the gap 330. As shown in Figure 11, the web is progressively drawn into the gap 330 as the web is conveyed from the top of the folding pan assembly to the bottom of the folding pan assembly.

The other fold, designated fold 180, corresponds to the second panel fold 80. The fold 180 is imparted to the continuous web as the continuous web passes over the tip edge 325 of the folding pan 320.

The continuous webs 150A-F are generally flat and inclined slightly to the plane of Figure 6 upstream of the folding pan assemblies 300A-F. The folded, continuous webs 150A-F are oriented at about a 90 degree angle with respect to the plane of Figure 6 as they leave the bottom of the folding pan assemblies and are conveyed between rollers 410, 420 and driven between nip rollers 430 and 440. Accordingly, the folded continuous webs 150A-F are viewed edgewise below the folding pan assemblies in Figure 6. The six folded, continuous webs 150A-F are then conveyed around turning rolls 460 and conveyed, one of top of another to provide group of six folded continuous webs 150A-F. The group is designated 540 in Figure 6.

The group 540 of continuous webs 150 can be cut at predetermined intervals at a downstream cutting station (not shown) to form separate, six count stacks of discrete, folded webs 50. Each of the folded webs 50 in the six count stack corresponds to one of the six continuous webs 150A-F. Multiple six count stacks of the discrete folded webs 50 can then be combined, one on top of the other, to provide the stack 40 shown in Figure 2.

In Figure 2, only four six count stacks are shown forming the stack 40, but it will be understood that many more six count stacks (e.g. 16 six count stacks for a total of 96 folded webs 50) will normally be combined in a container 20. The stack 40 can be loaded into the container 20 at a packing station, not shown.

The spacing between the edge folds 160 (provided by the folding tunnels 200) and the folds 170 (provided by the folding pan assemblies) is varied, lane to lane, from one continuous web to the next (e.g. from continuous web 150A to continuous web 150B) to provide staggered edge folds 60 according to the present invention. The spacing between the edge folds 160 and the folds 170 is varied by varying the position of the continuous webs with respect to the folding pan assemblies. The continuous webs can be shifted laterally by different amounts, from lane to lane, in order to vary the position of the continuous webs relative to the folding pan assemblies. Alternatively, the folding pan assemblies can be shifted laterally by different amounts, from lane to lane, in order to vary the position of the webs relative to the folding pan assemblies.

Referring to Figure 7, continuous web 150A is conveyed over folding pan assembly 300A such that the edge fold 160 is initially spaced a distance 360A from the

gap 330 in the folding pan assembly 300A. Continuous web 150B is conveyed over folding pan assembly 300B such that the edge fold 160 on continuous web 150B is initially spaced a distance 360B from the gap 330 in the folding pan assembly 300B. Continuous web 150C is conveyed over folding pan assembly 300C such that the edge fold 160 on continuous web 150C is initially spaced a distance 360C from the gap 330 in the folding pan assembly 300C. The distance 360A is greater than the distance 360B, and the distance 360B is greater than the distance 360C. Accordingly, the spacing between the edge fold 160 and the fold 170 on continuous web 150A will be greater than the spacing between the edge fold 160 and the fold 170 on continuous web 150B. Similarly, the spacing between the edge fold 160 and the fold 170 on continuous web 150B will be greater than the spacing between the edge fold 160 and the fold 170 on continuous web 150C. Accordingly, in the group 540 shown in Figure 6, the positions of the edge folds 160 in the group 540 will be staggered due to this difference in spacing.

For instance, the distance 360A can be at least about 0.25 inch greater than the distance 360B, and the distance 360B can be at least about 0.25 inch greater than the distance 360C. In one embodiment, the distances 360A-C differ by about 0.25 inch. Accordingly, the edge folds 60 in the end product folded webs 50 can be staggered a distance of about 0.25 inch.

The webs 150A-F can be individually guided so that each web is conveyed over its respective folding pan assembly to provide the desired variation in the distances 360 between the edge 152 and the respective gap 330. One method of positioning the webs laterally (perpendicular to the direction of travel in Figure 6) is by providing a pressure against the web adjacent to one of the edges 152 or 154. For instance, if a pressure is applied to the web in a direction perpendicular to the web (toward the viewer in Figure 6) and adjacent to the edge 152, the web will tend to move to the right in Figure 6. Alternatively, if a pressure is applied adjacent to the edge 154, the web will move to the left in Figure 6. One method of applying such pressures is by conveying the web over a steering roll (not shown). The steering roll can have a fixed first end and an adjustable second end. The position of the second end of the steering roll relative to the web can adjusted (such as by moving the second end of the steering roll toward or away from the viewer in Figure 6), thereby varying the pressure that is applied to the web across the width of the web.

In Figures 6-8, the edge folds 160 are imparted to the continuous webs 150A-150F, prior to forming the folds 170 and 180. The continuous webs 150A-F are then conveyed over the folding pan assemblies to provide the folds 170 and 180 corresponding to panel

folds 70 and 80 on the finished folded webs 50. This configuration has the potential disadvantage that the fold 160 may accidentally become unfolded before the other folds 170 and 180 are made.

Figures 9A-C and 10 illustrate an alternative method of forming the edge fold 160 and varying the spacing between the edge fold 160 and the fold 170 on adjacent continuous webs, such as webs 150A and 150B. Figures 9A-C are enlarged schematic illustrations of the webs being conveyed over their respective folding pan assemblies. In Figures 9A-C, the edge fold 160 is shown being formed by folding blocks 600 positioned along the folding pan assemblies 300A-C at different locations. Figure 10 is a cross-sectional illustration taken along lines 10-10 in Figure 9A showing an edge fold 160 as the edge 152 of a continuous web 150A is carried through a folding block 600. Folding block 600 has a generally cylindrical surface 610. The radius of the surface 610 helps prevent tearing of the web as the web is conveyed past the folding block 600.

Prior to positioning the folding blocks 600 on the folding pan assemblies, the webs are positioned laterally(such as with the above mentioned steering rollers) to provide the desired position of the web relative to its respective folding pan assembly. Referring to Figure 9A, the continuous web 150A is conveyed over folding pan assembly 300A such that the web edge 152 is initially spaced a distance 370A from the gap 330 in the folding pan assembly 300A. In Figure 9B, continuous web 150B is conveyed over folding pan assembly 300B such that the edge 152 on continuous web 150B is initially spaced a distance 370B from the gap 330 in the folding pan assembly 300B (Figure 9B). Referring to Figure 9C, continuous web 150C is conveyed over folding pan assembly 300C such that the edge 152 on continuous web 150C is initially spaced a distance 370C from the gap 330 in the folding pan assembly 300C. The distance 370A is greater than the distance 370B, and the distance 370B is greater than the distance 370C.

Accordingly, the spacing between the edge 152 and the fold 170 on continuous web 150A will be greater than the spacing between the edge 152 and the fold 170 on continuous web 150B, and the spacing between the edge 152 and the fold 170 on continuous web 150B will be greater than the spacing between the edge 152 and the fold 170 on continuous web 150C.

Once the positions of the webs with their respective folding pan assemblies are established to provide the desired distances 370, the folding blocks 600 are positioned on the folding pan assemblies. The folding blocks 600 are joined to the respective folding pans 310 at a position just upstream of the position at which the edge 152 would enter the gap 330 if the folding blocks 600 where not present. Placement of the block in such a

position has been found to result in the formation of the edge fold 160. Importantly, the edge fold 160 is formed as the web is conveyed between the leading edge of the folding pan assembly and the folding block 600, just prior to the point where the edge fold 160 is drawn into the gap 330. As the edge fold 160 is drawn into the gap 330, the edge 152 is positioned between other portions of the web, as shown in Figure 10, thereby minimizing the chance of the edge fold becoming unfolded.

Without being bound by theory, it is believed that placing the folding block 600 in such a position creates the edge fold 160 by interrupting the path of the portion of the web adjacent to the edge 152. It is believed this interruption of the path of the edge 152 causes the edge 152 to curl toward the viewer in Figures 9A-C, resulting in formation of the edge fold 160.

In Figures 9A-C, the edge folds 160 are not imparted to the continuous webs 150A-C until the continuous webs have been at least partially folded by the folding pan assemblies. In particular, the edge folds 160 are not formed until the fold 170 is initiated in the gap 330.

The folding blocks 600 can be made from any suitable material, including but not limited to stainless steel and hard plastics.

It has been found that the folding blocks 600 can be positioned at different locations along the folding pan assemblies to provide the edge fold 160, yet the edge folds 160 are spaced generally equally from the web edges 152 on each of the continuous webs 150A-F. The resulting web lip between the edge fold 160 and the web edge 152 will accordingly be generally the same size for each of the continuous webs.

However, the spacing between the edge folds 160 and the folds 170 will vary (the spacing varying in decreasing order from continuous web 150A to continuous web 150C in Figures 9A-C) due to the differences in the distances 370A-C. The fold 170 is initiated as the web first enters the gap 330 at the leading edge of the folding pan assembly. Therefore, the spacing between the edge fold 160 and the fold 170 increases as the spacing 370 between the edge 152 and the gap 330 increases.

While particular embodiments of the present invention have been illustrated and described, various changes and modifications can be made without departing from the spirit and scope of the invention. It is intended to cover, in the appended claims, all such modifications and intended uses.

WHAT IS CLAIMED IS:

1. An assembly of discrete, folded webs, the webs disposed one next to another to form a stack;

each web extending lengthwise from a first end edge to a second end edge; and each web having an edge fold positioned adjacent to, and spaced from, the first end edge for facilitating grasping of the web adjacent the first end edge; and

wherein the positions of at least some of the edge folds are staggered in the stack.

2. The assembly of Claim 1 wherein the positions of at least some of the edge folds are staggered a distance at least as great as the spacing between the edge fold and first end edge.

3. The assembly of Claims 1 or 2 wherein the spacing between the edge fold and the first end edge is less than about 0.50 inch, and preferably between about 0.15 inch and 0.35 inch.

4. The assembly of Claims 1, 2 or 3 wherein the positions of the edge folds are staggered in a predetermined manner, the positions of the edge folds preferably being staggered in a repeating pattern to provide at least three different edge fold positions within the stack.

5. The assembly of Claim 1, 2, 3, or 4, wherein adjacent webs are non-interfolded.

6. The assembly of Claims 1, 2, 3, 4, or 5 the folded webs are premoistened wipes.

7. The Claims 1, 2, 3, 4, 5 or 6 wherein the webs are disposed one on top of another to form a stack, each folded web extending lengthwise from a first end edge to a second end edge, and each folded web having:

an edge fold positioned adjacent to, and spaced from, the first end edge of the folded web to provide a web lip extending between the edge fold and the first end edge of the web;

a first panel fold generally parallel to the edge fold, the first panel fold spaced from the edge fold to provide a first web panel extending between the first panel fold and the edge fold, the web lip being joined to the first web panel at the edge fold; and

a second web panel joined to the first web panel at the first panel fold;

wherein at least one web in the stack has a spacing between the edge fold and the first panel fold which is different from the spacing between the edge fold and the first panel fold on at least one other web in the stack.

8. The assembly of Claim 7 wherein the spacing between the edge fold and the first end edge is between about 0.15 inch and about 0.35 inch.

9. The assembly of Claim 7 or 8 wherein the spacing between the edge fold and the first panel fold varies between adjacent webs in the stack.

10. The assembly of Claim 7, 8, or 9 wherein each web further comprises a second panel fold and a third web panel, wherein the third web panel is joined to the second web panel at the second panel fold, and wherein the web is folded at the first and second panel folds to provide the first, second and third web panels in a Z-fold configuration.

11. A method of forming a stack of discrete, folded webs having edge folds staggered in the stack, the method comprising the steps of:

providing at least two continuous webs;

forming an edge fold on each continuous web, the edge fold adjacent to and spaced from an edge of the continuous web;

forming at least a first panel fold on each continuous web; wherein the spacing of the edge fold from the first panel fold on one of the continuous webs is different from the spacing of the edge fold from the first panel fold on at least one of the other continuous webs;

forming discrete, folded webs from each of the folded continuous webs; and

arranging the discrete folded webs one on top of another to form a stack of the discrete folded webs.

12. The method of Claim 11 comprising the steps of:

providing a folding apparatus corresponding to each of the continuous webs for forming the first panel folds;

positioning each continuous web relative to its respective folding apparatus, wherein the position of a first continuous web relative to its respective folding apparatus is different from the position of a second continuous web relative to its respective folding apparatus; and

forming the first panel fold on each continuous web with the folding apparatus corresponding to the continuous web.

13. The method of Claim 12 wherein the step of forming the edge folds is performed before the step of forming the first panel folds.

14. The method of Claim 12 wherein the step of forming the edge fold is performed after intiating the step of forming the first panel fold.

15. The method of Claim 11, 12, 13, or 14 comprising the steps of:

providing at least three continuous webs;

providing a folding apparatus corresponding to each of the continuous webs; and

positioning the three continuous webs differently relative to their respective folding apparatuses to provide three folded continuous webs having three different spacings of the edge fold from the first panel fold.

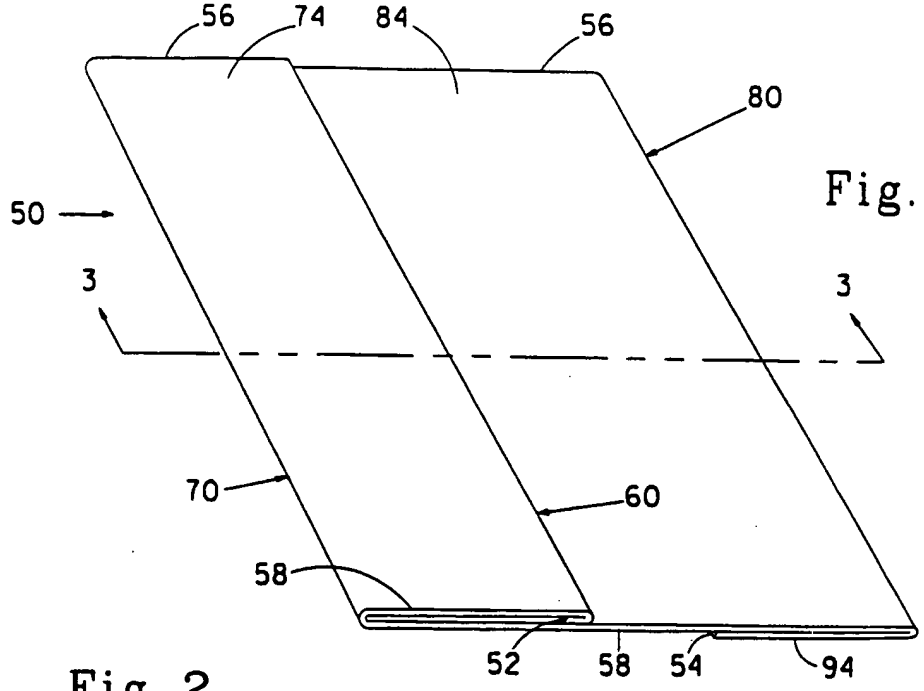
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Fig. 1

Fig. 2

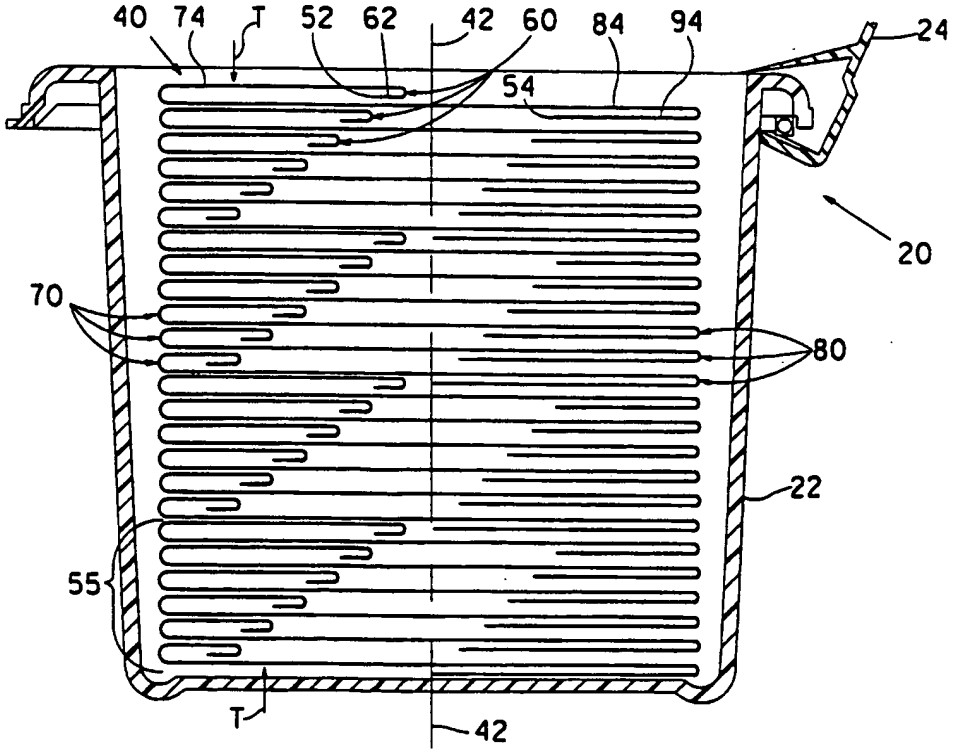
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Fig. 3

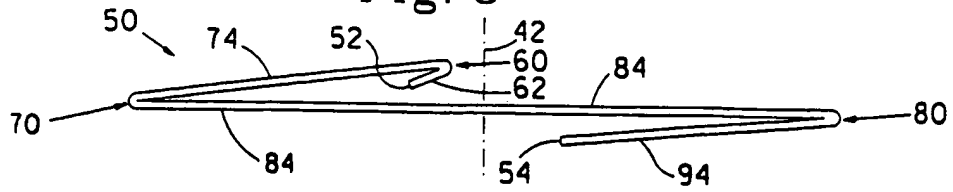
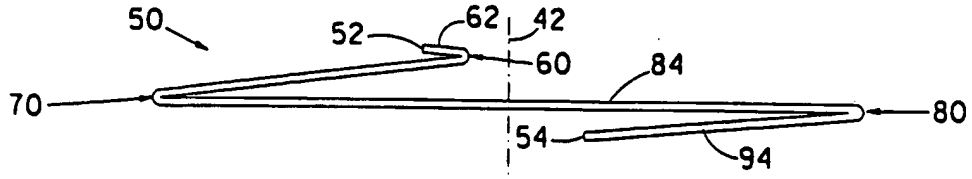


Fig. 4



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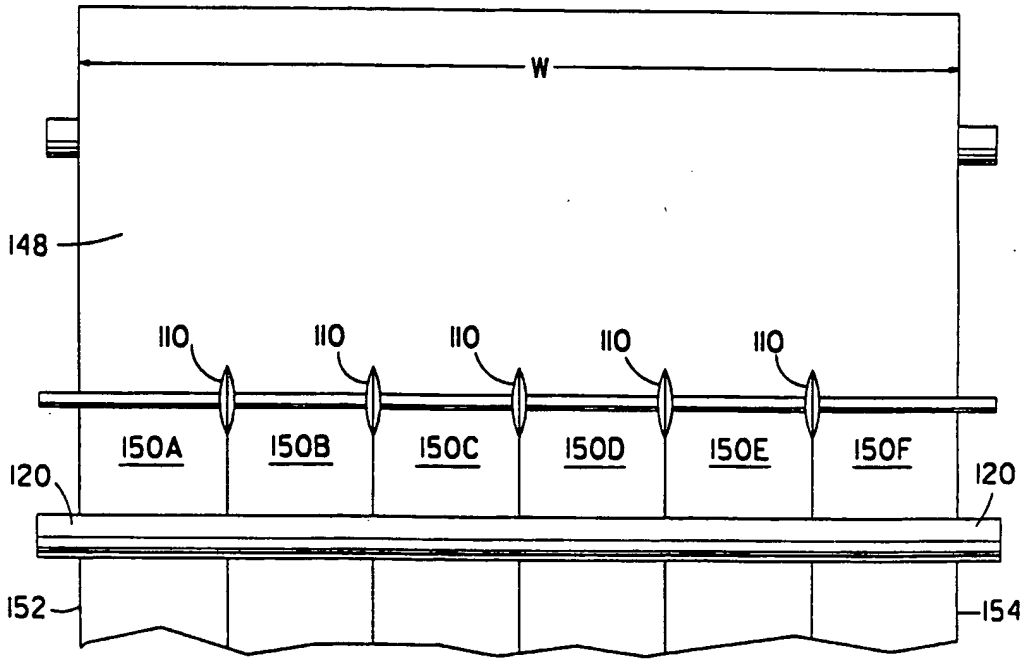

Fig. 6

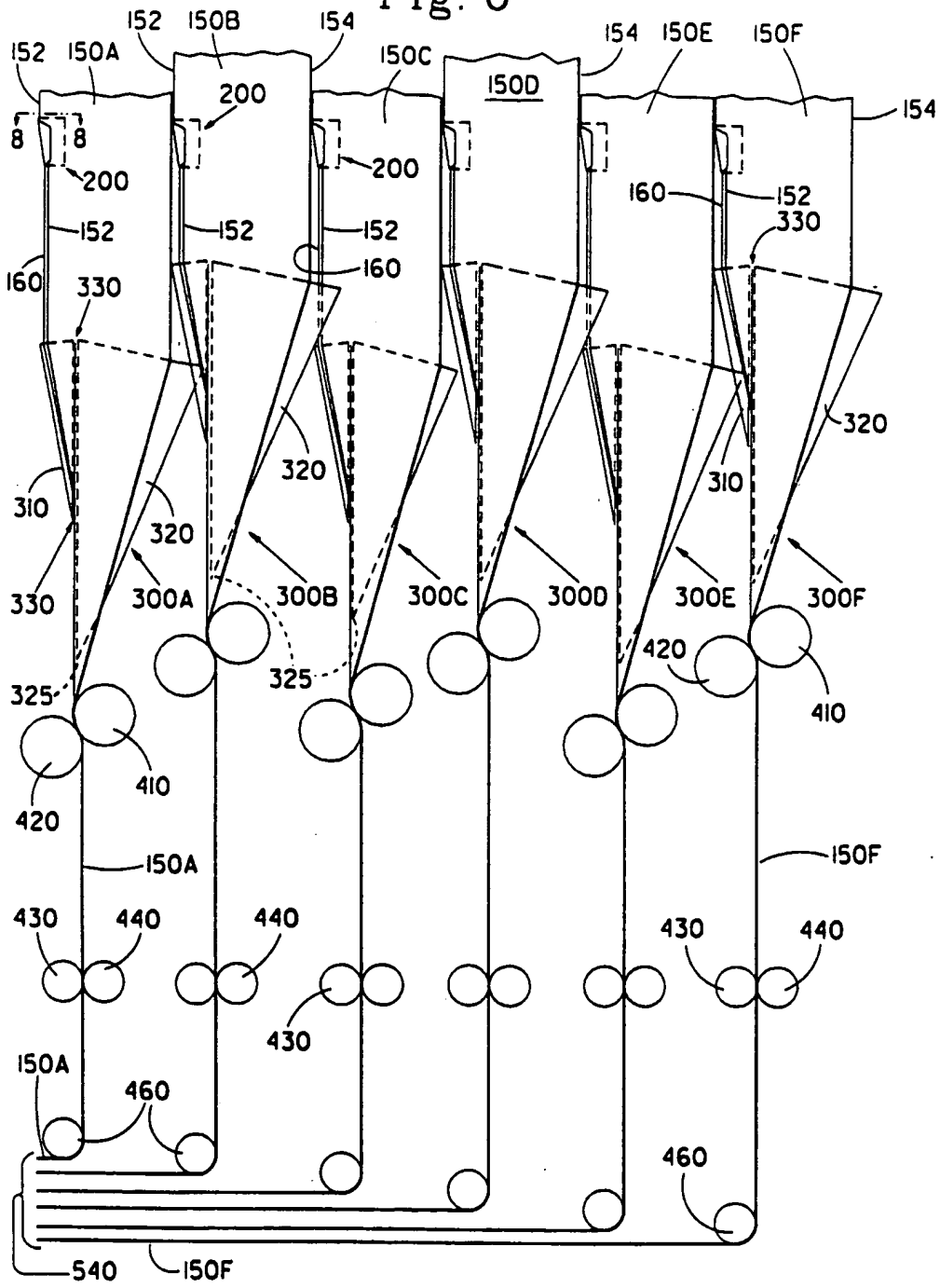
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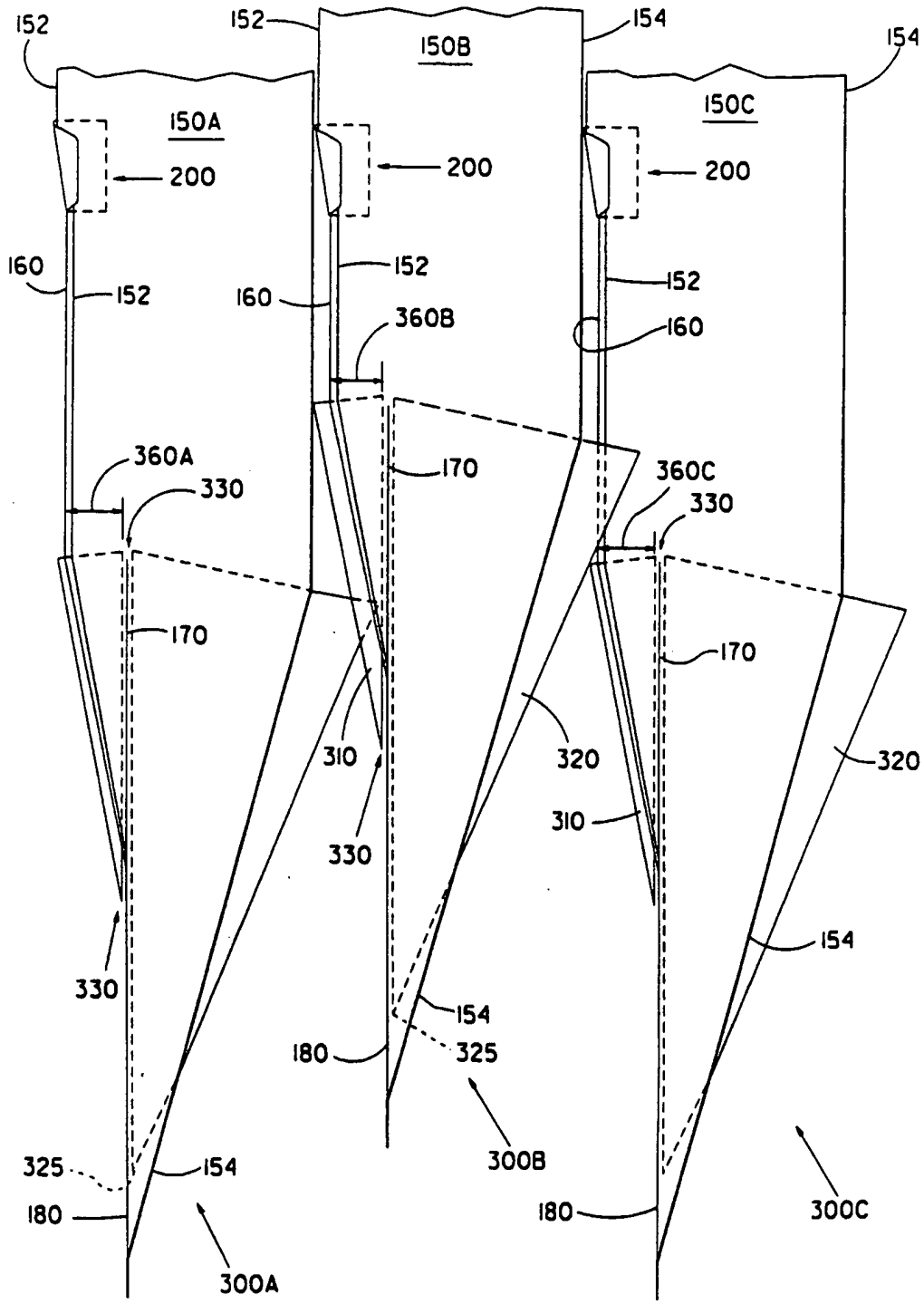
Fig. 7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300C

Fig. 8

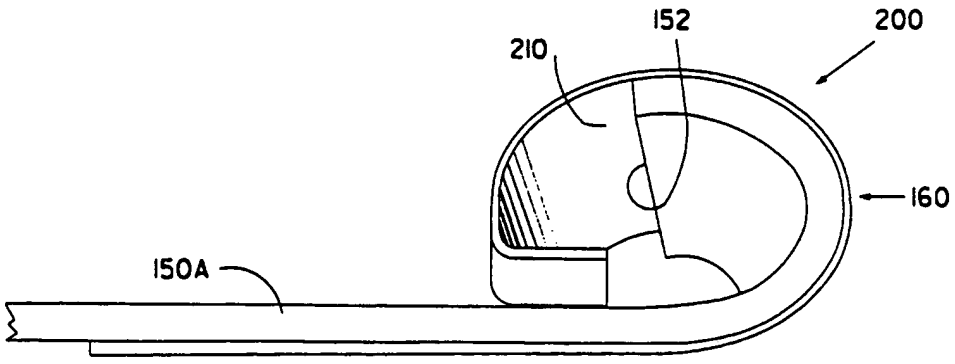

Fig.9A

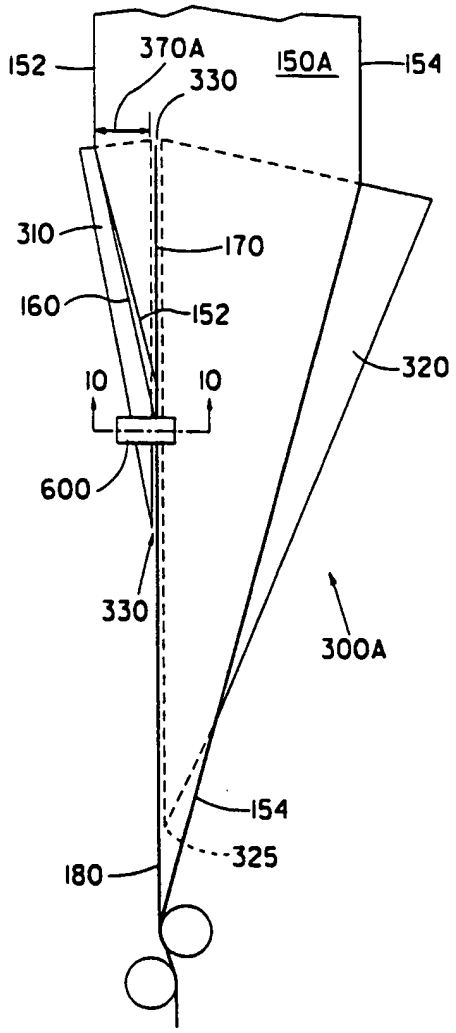
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Fig. 9B

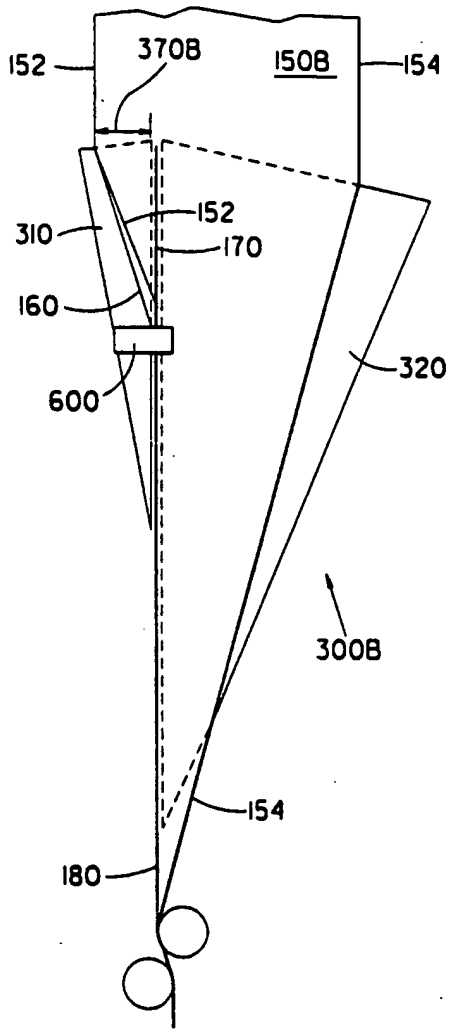

Fig.9C

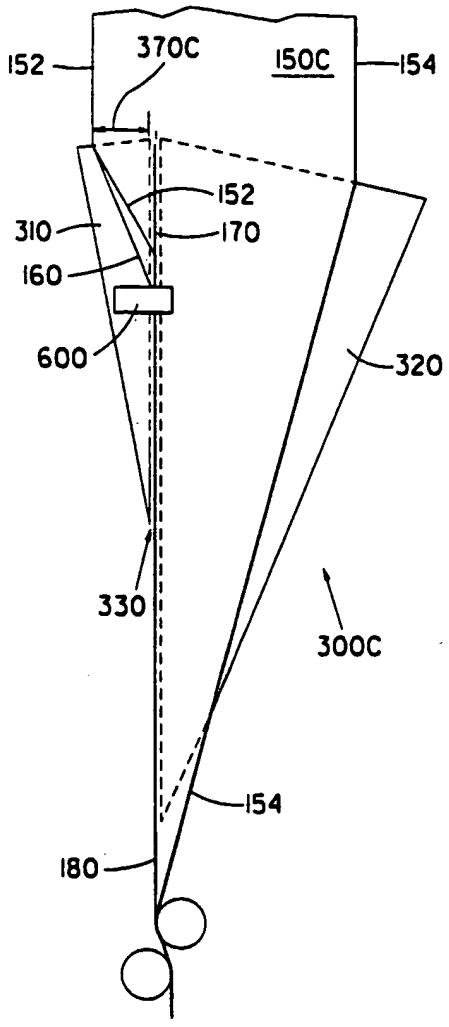

Fig. 11

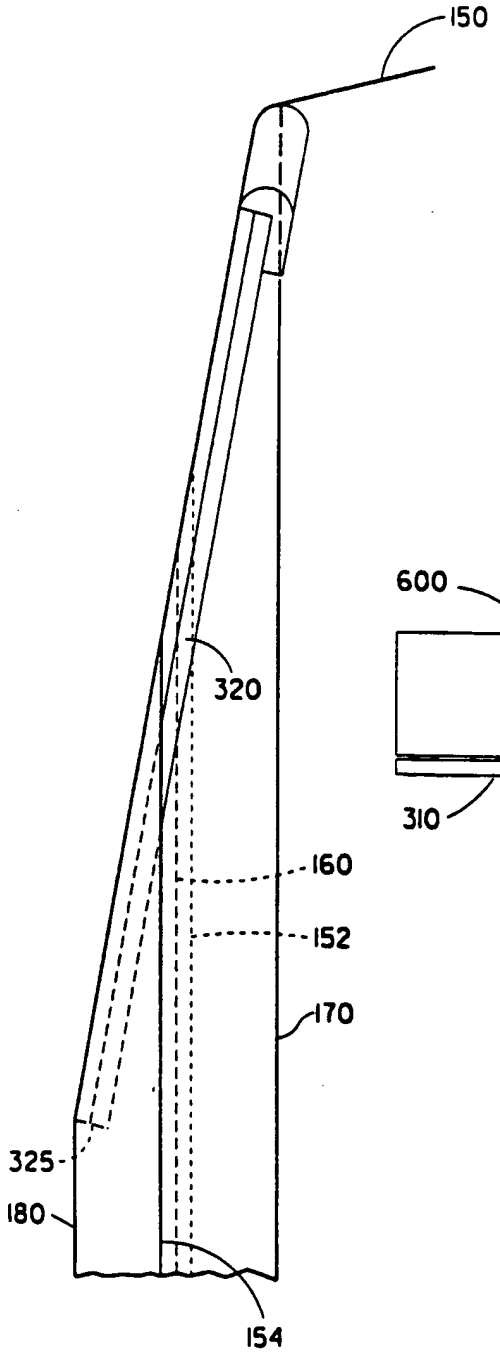
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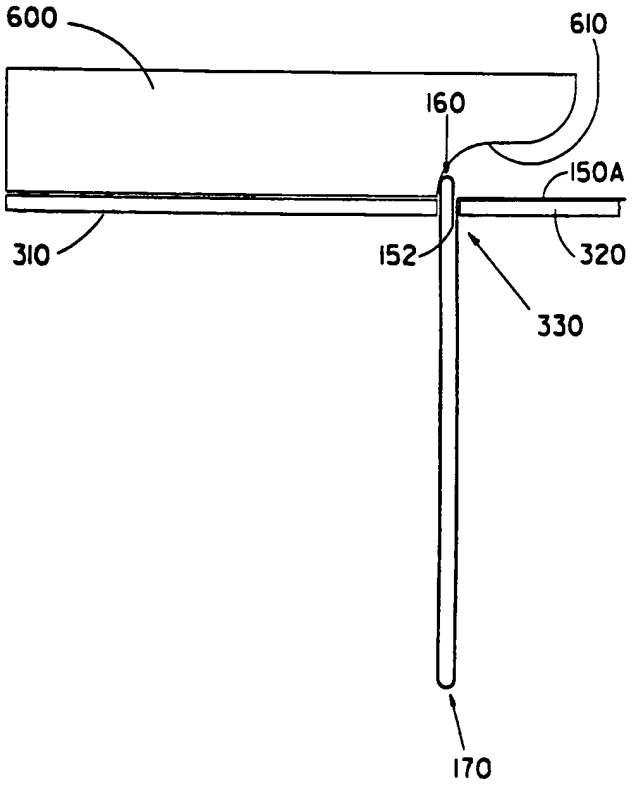
Fig. 10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INTERNATIONAL SEARCH REPORT

Inte . ational Application No
PCT/US 97/21645

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B65H45/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B65H B31F A47K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category '	Citation of document, with indication, where appropnate, of the relevant passages	Relevant to claim No.
X	US 3 462 043 A (R. H. FRICK) 19 August 1969	1,2,5
A	see column 5, line 52 - column 7, line 52; figures 3,6,8,9,11	7,11,12

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

2

Date of the actual completion of the international search	Date of mailing of the international search report
27 March 1998	07/04/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Raven, P

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. tional Application No
PCT/US 97/21645

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3462043 A	19-08-69	GB 1199956 A	22-07-70